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CONTENTS

ERRATUM: In JPRS 82224 of 12 November 1982, No. 759 of this series, the sourceline of the article "Textbook Covers Chemical, Biochemical Methods of Analyzing Toxic Agents" on page 1 should read "East Berlin LEHRBUCH DER MILITAERCHEMIE in German 1977 (signed to press 15 Feb 76) Vol 2 pp 299-400; 403-480," correcting the place of publication.

BULGARIA

NEW TECHNOLOGIES APPLIED IN PRODUCTION

Cybernetic Equipment

Sofia ECONOMIC NEWS OF BULGARIA in English No. 8, 82 p 4

[Article by Eng. Yulian Danchev]

[Text] A team of young research engineers at the Institute of Technical Cybernetics and Robotics at the Bulgarian Academy of Sciences has designed a microprocessor modular system MIK for the construction of various cybernetic devices, used in the automation of various technological processes. When compared with numerous similar systems currently designed by diverse companies, the system developed by the cybernetic engineers in Sofia impresses one with its updated concept, as well as with the versatility of application. The circuit diagram and the design of all modules is based on a very sensible approach, comprising the design of specialized functional blocks, suited for mass production, and offering a possibility to be combined into systems designed for various applications. This approach has created adequate conditions for attaining fast response and operational reliability. The most essential feature is probably the possibility for the circuit to secure priority application of input-output modules in random sites of the address space of the memory. This offers a possibility for easy broadening of each of concretely realized systems to achieve new goals, not considered during the initial construction. In the rapidly changing conditions of modern industry and technology, this remerkable feature ensures a possibility to modernize and enlarge a manufacturing facility, without the need to replace already installed expensive equipment.

When we consider the merits of the MIK microprocessor modules, we must stress especially the excellent basic programmes which are an integral part of all concrete realisations. They comprise monitoring programmes, residential and disc operational systems, translators and interpreters for problem oriented languages of high level. Depending on the concrete technological application, each system is equipped with a practical target-oriented programme.

A confirmation of the originality of the modular system are the numerous patents issued to the inventors. The Bulgarian cybernetics engineers have made a very competitive appearance on the market, proved by the fact that many world-known companies in the electronic equipment business have offered joint venture contracts, make inquiries for licensing, asking for patent concessions. The British company "S.K. Ltd." has already signed a contract for the purchase of technological automation equipment worth several hundred thousand US dollars. The

Greek tobacco syndicate is considering the "MIK" – based system for automatic sorting of tobacco leaves. A major consignment is being prepared for Libya of systems for the automation for vegetable growth in greenhouses. A system for the optimisation of concrete mixing was accepted with even greater interest.

The microprocessor system of modular components MIK, as well as several distinct applications: DELTACHROME for automatic sorting of oriental tobacco leaves: EKO – for greenehouse automation vegetable and flower growing; BETON–CONTROL – for the optimisation of concrete mixes; a system for the complex automation of the processes in the reactor for the production of suspension PVC; a system for the automatic control of fibre-optics manufacturing processes; and a system for the automatic programming, using all the basic programmes of MOTOROLA. The Bulgarian Foreign Trade Organization TECHNIKA provides quotations and further information about these items.

Betoncontrol Design

Sofia ECONOMIC NEWS OF BULGARIA in English No. 8, 82 p 4

[Text] It is designed for the automatic control of processes in concrete mixing equipment. It ensures stabilization of mixture consistency, hence substantially reduces deviations in strength characteristics of concrete. The process consists of accurate checking of the moisture content in the aggregate used for the concrete – gravel and sand, and correcting the memory-stored recipes to take into account the monitored moisture content, automatic batching of the plasticiser (water), and controlling the mixing process.

The stability with which BETONCONTROL controls the concrete mixing process has offered a possibility to revise both the consumption norms for cement, as well as the indicators of concrete strength. As a result, substantial economies are achieved by using lower-grade cements, to obtain the same strength characteristics of the cured concrete. The productivity of concrete mixing equipment is also increased, and labour is made easier. BETONOCONTROL is patented in Bulgaria and abroad.

Controlled Reactor for PVC

Sofia ECONOMIC NEWS OF BULGARIA in English No. 8, 82 p 4

[Text] By using the MIK microprocessor modules as components, a system has been designed for the automatic control of processes in a suspension PVC reactor. The system offers a possibility to stabilize and optimize the basic parameters of the production process. Owing to the hostile environment, inherent in the chemical process, and the position of the reactor in the continuous production line, a possibility is achieved for data exchange with a central computer controlling the entire technologcal complex. The system is compatible with similar microcomputer systems for technological automation, which simplifies interfacing substantially.

The entire process is traced by in-line control. Reports can be also issued for longer periods. The operator can start an interactive dialogue and interfere in the control of the process.

Automatic Manufacture of Fibre-Optics

Sofia ECONOMIC NEWS OF BULGARIA in English No. 8, 82 p 4

[Text] The very delicate process of drawing glass fibres for fibre-optics has been successfully automated by the use of the microprocessor modules of the MIK series. The parameters of temperature, drawing speed, diameter of the filament, etc. are checked. Control is achieved through a programme, written in the specialized target-oriented language MICROBASIC. The high speed, inherent to the drawing process, and the narrow interval within which the parameters must be controlled, has forced the use of unique patented circuits.

The technological equipment of miscellaneous design used in glass fibres (built by different manufacturers), presumes individual designing in each separate case, at least as far as the peripherals, sensors, and interface is concerned. This means a comprehensive preliminary study of the equipment to be controlled. The study is made as part of the tendering process. As a result of the implementation of the automatic system for the control of glass fibre drawing for fibre-optics, rejects are dramatically reduced, and variations in the diameter of fibres and their optical characteristics are reduced to a minimum.

Greenhouse Control

Sofia ECONOMIC NEWS OF BULGARIA in English No. 8, 82 p 4

[Text] The EKO system is designed for the automatic control of the microclimate in greenhouses. It is equipped with sensors for checking the environmental parameters: temperature, illumination, force and direction of the wind, presence of rain, as well as sensors monitoring the microclimate in the greenhouse: air temperature, moisture, temperature of the heating water, angle at which the fresh-air inlets are opened, etc. As a result of computerized processing of the acquired data, all the systems affecting the microclimate are automatically controlled. Thus optimal conditions are created for the growth of the plants, which in turn ensures higher yields.

The operator, an agronomist, can interfere and alter the initial parameters. This is achieved through the interaction console, and the output printer of the system. In accordance with the accepted growth pattern of the respective plant, and the soil used, the system can be modified and the accuracy and limits of automatic control may be altered.

The EKO system comprises all the necessary items for mounting the equipment in field conditions. The separate items are custom designed, in accordance with the requirements of the technological project. For overseas customers, the design, delivery, and commissioning is done by the TECHNOEXPORTSTROY Co

Tobacco Sorter

Sofia ECONOMIC NEWS OF BULGARIA in English No. 8, 82 p 4

[Text] This is the name of a system for automatic sorting of oriental tobacco leaves by colour. The oriental tobacco leaves, unlike the broad-leaf Virginia variety are small, and with very slight differences in the colour shades. This peculiarity has necessitated an original technical solution of "colour head", which is basically an analyser of the rapidly passing tobacco leaves under the head. The signals generated by the analyser control a fast-response pneumatic system, which distributes into different containers the tobacco leaves, according to their colour. This operation requires one hundredth part of the second, while the best manual sorter needs up to 5 seconds to do the same job. The system comprises a monitor, and a CRT on which the operator, with the aid of a light-pen enters the programmes of the different colour shades. During operation the operator monitors through the CRT the flow of leaves, and uses data for the correction of the sorting criteria.

The experience accumulated up to now shows that DELTA-CHROME can substitute successfully the qualified labour of 150 sorters. The annual capacity of the system is more than 6000 tons of tobacco leaves. About 144 similar systems will be implemented in the tobacco processing factories in Bulgaria by the end of 1985.

CSO: 2020/4

BULGARIA

RADIOPROTECTION FROM GENETIC INJURY, DEATH EXAMINED

Sofia RENTGENOLOGIYA I RADIOLOGIYA in Bulgarian No 2, 1982 pp 76-79

[Article by D. Benova, MA, Scientific Research Rentgenology and Radiobiology Institute, Prof I. Nikolov director: "The Role of ATP in the Radioprotective ATP-AET-Serotonine in Protection from Radiation Death and Radiation Genetic Injury"]

[Text] Interest in the use of combinations of radioprotectors for protection from radiation injury has increased in recent years. This is due not only to their greater efficiency compared to the separate application of the substances but to the greater opportunity to clarify the mechanism of action of anti-radiation preparations. Our previous works offered detailed studies of the toxic and radiation protection characteristics of radioprotector AET, serotonine and ATP and their combinations (1). It was determined with the help of isobolograms that the optimal dose correlation which makes the triple combination highly efficient and possibly least toxic in protection from radiation death is ATP:AET:serotonine 45:3:1. This combination in a dose of ATP 360 mg/kg, AET 24 mg/kg and serotonine 8 mg/kg had a favorable influence on radiation genetic injury in mice (8).

The studies made to determine the role of each individual component within the overall protective effect regarding two different indicators--radiation death and genetic injury, caused by two different radiation loads, are of interest with a view to explaining the mechanism of action of this triple combination consisting of three differently acting radioprotectors. This work describes the role of the ATP in the general effect of the triple combination in protection from radiation death and reciprocal translocations in mice spermatogonia induced by 4 Gy X-rays.

Materials and Methods

We used male mice of the C57BI strain, 12 to 14 weeks old, weighing from 22 to 26 grams. The radiation was induced with the X-ray machine RUM/180 kV, 15 mA, filter Al 3 mm, a distance of 0.50 cm, and a dose of 0.7 Gy/min. The protectors were introduced slowly, intraperitoneally, 1 ml of water solution of a mechanical solution of ATP (Adenosis-5-triphosphoric acid disodium salt, Reanal), AET (2-2-aminoathyl (2-thiopsendoharnstoff dihydrobromid, Schuchard) and serotonine (serotonine creatinine sulphate Reanal), prepared ex tempore, 8

minutes prior to radiation. The dose was averaged for a 25 gram heavy mouse. The control mice were administered 1 ml of distilled water. The lethality was recorded daily up to the 30th day following the radiation with 8.5 Gy X-rays. The induced reciprocal translocations in the spermatogonia of the mice were recorded at the spermatocite stage in a diakinesis metaphase I about 100 days after radiation with 4 Gy X-rays. The preparations for cytogenetic analysis were developed from mice testes, using the method of Evans et al (9). The statistical processing was based on the methods of variation analysis and the criterion X^2.

Results and Discussion

The results of the influence of ATP and its combinations with AET and serotonine on radiation injury are shown on Table 1. Under our conditions the dose 8.5 Gy X-rays was the lethal dose 100/11. ATP introduced independently in a dose of 400 mg/kg and in combination with AET 24 mg/kg showed no protective effect in terms of 30-day survivability. All we noted was a certain extension of the average life span. Combined with serotonine with a lower dose of the latter--8 mg/kg--survivability was 60 percent. The triple combination of the doses had very good protective results but in all likelihood the basic role is played by the other two components--AET and serotonine, for the double combination is highly effective (90 percent survivability). In our previous studies involving a wide surface of the triple combination and the method we developed we were able to prove that the importance of ATP in the general effect of the triple combination against radiation death is very low (1).

Table 1. Protective Effect of ATP and Its Combinations with AET and Serotonine Against Radiation Death and Genetic Injury in Mice

1) Групи	2) Доза лъчение (Gy)	3) Доза на протектора (mg/kg)	4) Радиационна смърт		7) Генетично увреждане		
			5) бр. жив.	6) 30-дневна преживяемост %	8) бр. жив.	9) анализ. метафази	10) клетки с трансл. % ± SE
—	8,5	—	100	0	—	—	—
—	4,0	—	—	—	20	3805	7,56±0,6
АТФ 11)	8,5	400	20	0	—	—	—
АТФ 11)	4,0	360	—	—	7	1370	7,52±0,8
АТФ + АЕТ 12)	8,5	400+24	20	0	—	—	—
АТФ + АЕТ 12)	4,0	360+24	—	—	8	1600	5,94±0,6
АТФ + серотонин 13)	8,5	400+8	20	60	—	—	—
—	4,0	—	—	—	10	2000	9,80±0,8*
АТФ + серотонин 13)	4,0	360+8	—	—	10	2000	7,10±0,8*
АЕТ + серотонин 14)	8,5	24+8	20	90	—	—	—
АЕТ + серотонин 14)	4,0	24+8	—	—	10	2000	6,15±0,6
15) АТФ + АЕТ+серотонин	8,5	360+24+8	40	90	—	—	—
15) АТФ + АЕТ+серотонин	4,0	360+24+8	—	—	10	2000	3,7±0,5

16) *Облъчването е проведено от друг източник (Müller T 250—190 kv, 20 mA, Al 3 mm мощност 0,024 Gy/s)

Key: See next page

Key:
1. Group
2. Radiation dose (Gy)
3. Protector dose (mg/kg)
4. Radiation death
5. Number of living
6. 30-day survivability %
7.
8. Number of living
9. Metaphase analysis
10. Translocation cells %± SE
11. ATP
12. ATP + AET
13. ATP + serotonine
14. AET + serotonine
15. ATP + AET + serotonine
16. Radiation from another source (Muller T 250-190 kv., 20 mA, Al 3 mm power 0.024 Gy/s.

What is the role of ATP in the overall protective effect of the combination against radiation-induced genetic injury? Applied separately in a dose of 360 mg/kg it has no influence on the quantity of induced reciprocal translocations. Its combinations with AET and serotonine are ineffective. However, the combination of the three radioprotectors proved to be very advantageous: the number of translocations declined by one-half. We know that in terms of this indicator a reduction by more than 50 percent has not been recorded so far (6, 7, 8). Unlike the results regarding protection from radiation death, the role of ATP is clearly significant, for the double combination of AET and serotonine has a relatively lower effect--6.15 percent of the cells with translocations, compared with 7.56 percent in nonprotected cells. The studies of a number of authors on the influence of ATP on the lethal effects of radiation indicate that it is a medium effective protector (3, 10). Its influence in radiation damage indicators, however, in which restoration processes are of basic significance, is very favorable (4, 12). Our data indicate that the significance of ATP in the general effect of the triple combination, applied in an optimal dose ratio, varies in the two studied indicators. In protection from radiation death ATP has no influence whatever on the two powerful radioprotectors--AET and serotonine. This is most likely due to the fact that with such high radiation load (8.5 Gy) the effective protectors act mainly as receptors of energy and reduce the primary injuries (2,5). The importance of the preparation in terms of the eventual outcome is far lesser. With a lower radiation (4 Gy) and with a genetic indicator recorded after a number of cellular divisions, in this case the restoration processes in the cell, in this case induced in the spermatogenic translocations and recorded in the spermatocites 3 months after radiation, are of essential importance. Applied by itself, ATP cannot reduce the translocations. Added to AET and serotonine, which reduce the cellular death of spermatogonia (11), it can have a favorable effect on reparation processes in the survivors and can reduce the number of mutations.

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Summary. In our previous studies it was demonstrated that the radioprotective mixture ATP-AET-Serotonine exerts a very good protective effect against radiation death and radiation genetic injury. ATP applied alone is known to be a weak radioprotector. Of interest are the studies which demonstrate the extent to which ATP influences the effectiveness of the potent chemical agents AET and serotonine and its role in the overall effect of the combination. The present study shows that in terms of the protection from radiation death, the addition of ATP to the other two components is of no importance. However, the role of ATP in protection from radiation genetic injury is of major importance. Its absence diminishes the protective capabilities of the radioprotective mixture against the induction of reciprocal translocations in the spermatogonia.

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NEW ELECTRONIC COMPONENT PRODUCTION TECHNOLOGIES SURVEYED

Prague TELEKOMUNIKACE in Czech No 8, 1982 pp 125-127

[Article by Eng Rudolf Sorm, TESLA--A. S. Popov Research Institute of Communications Technology, Prague: "Development of Component Technologies for Communications"]

[Text] Electronic components for telecommunications are an important part of the components base for electronics as a whole. As the incorporation of electronics into telecommunications proceeds, the volume of electronic components for this field also grows. The components are already subject to considerable requirements as regards life, reliability and long-term stability of characteristics, which are typical in communications but uncommon for electronics as a whole. Telecommunications has become a new large-scale customer for the electronic components base.

Main Silicon-based Microelectronics Technologies

What is the current status of silicon-based integrated circuit technology? What is the status of this technology abroad and in Czechoslovakia? Finally, what can our institute, TESLA-VUST [A. S. Popov Institute of Communications Technology], make available for telecommunications technology in the near future? These are the main questions of the current 5-year plan, and from them we can derive the prospects for the immediate future.

Of extreme importance are the status and prospects of integrated circuit [IC] production here and abroad and the selection of IC's produced. Currently the worldwide trend is to relatively complex IC's, suited for large-scale incorporation into a variety of applications, thus making possible production in larger series without the need to develop custom-made circuits. This trend manifests itself in the use of microprocessors and microcumputers, the most modern IC's, for general control functions. This is also the trend in Czechoslovakia and in IC applications in the telecommunications field. Thus microprocessors and microcomputers are the most promising area of integrated circuits. Memories of all types, RAM [random access memory], ROM [read-only memory], PROM [programmable read-only memory] and the like, supplement these IC's and expand their capabilities.

The earlier idea that every application would require its own special IC has now been superseded. The use of microprocessors and microcomputers with

their own specific software is now fully replacing the earlier ideas of large-scale use of custom-made circuits. Concentrating development efforts on a few selected circuits has made it possible to decrease the unit price to such a low level that new applications areas are continually being opened up for integrated circuits, with the result that electronics is entering areas in which it had not previously been applied or where its use had been only marginal.

The use of complex circuits makes it possible to modernize not only telephone equipment but telephone exchanges as well, and thus to make the changeover from electrical and electromechanical components to electronic components in the telecommunications field. The use of microprocessors and microprocessor-based circuits thus makes it possible to solve telecommunications problems at an entirely new, qualitatively higher technical and technological level.

What is Czechoslovakia's situation in this respect? Bipolar microprocessors and accessory circuits for their large-scale application have now been developed and their production partially mastered. IC's of the 8080 and 3000 series, including memory and auxiliary circuits, have been prepared for large-scale application, including use in the telecommunications field.

Special circuits for telecommunications areaalso being prepared. In particular, they include the following:

--crosspoint matrices which make it possible to replace relay systems with fully electronic systems in exchanges;

--sets of circuits for pushbutton dialing, allowing the rotary dial to be replaced by fully electronic dialing devices, including memory for most frequently dialed numbers, for both pulse and tone dialing;

--a codex [coder-decoder], with or without filter, allowing the digital system of a telecommunications unit to be connected to an analog system, which is currently usable in telecommunications exchanges;

--sets of adapter circuits allowing PCM [pulse code modulation] digital inputs and outputs to be interfaced with exchanges and vice versa. Technologically, all of these circuits are now realized as very complex IC's, whose advent is a contribution of the telecommunications field. Most of the circuits are derived from microprocessors and their accessories, and thus are circuits of a complexity which is not yet required in other fields. Their use in CEMA's joint development of unified telecommunications systems (JSPST, The Unified System of Communications Facilities; JSCPI, the Unified System of Digital Data Transmission).

These circuits are being prepared for use in the current 5-year plan and should begin to be introduced in large numbers after 1985, in other areas as well as telecommunications. The development of complex circuits for one applications area and their large-scale application even outside this basic area is a typical phenomenon in modern IC technology.

What is our institute, TESLA-VUST, doing for telecommunications? It has already begun test operation of our facility for producing CMOS [complementary metal-oxide-silicon] circuit chips. In choosing a suitable IC technology for the pilot facility, we settled on CMOS technology because of its very low power consumption, although in design terms these are the most complex type of circuits. This choice proved correct; the modern branch exchanges now in production at Tesla hiptovy Hradok use CMOS circuitry, and many other telecommunications and radio communications applications are being prepared using this technology. Thus, CMOS technology has become a Czechoslovak specialty and is also a sutiable area for international division of labor among the CEMA countries.

As might be expected, the focus of work for the immediate future is thus quite clear: it involves building a special components base for telecommunications in our institute, particularly using CMOS technology, and preparations for the design of more complex circuits, progressing from today's chips with several thousand components to chips with hundreds of thousands of components in the near future. This is also the main direction of development of microelectronics as a whole, both abroad and in this country.

Main Optoelectronic Component Technologies for Telecommunications

In the currently developing field of optoelectronic communications, TESLA-VUST is coordinating Czechoslovak research and development work in the context of the state plan for scientific and technical development. The concurrent solution of specific problems in materials and components research is directed, for the immediate future, at production development of a modular system for data transmission in computer and automation applications. In addition, research for the next stage in performance of the optoelectronics program, i.e., broadband transmission of the telecommunications type, has been begun. This task is being carried out in coordination with the special basic research program on Optical Communications, in which FEL [Electrotechnical Department] of CVUT [Czech Institute of Technology] is also participating.

In the materials area, TESLA-VUST's research is based on the technology which has been developed for preparing monocrystals of the semiconductors GsAs and GaP using the Czochralski pressure method under a hydraulic seal. Applied research on InP monocrystals has now been completed and research on the preparation of GaInAs/InP epitaxial films is under way. In addition, work is proceeding, jointly with the Institute of Physics, CSAV [Czechoslavak Academy of Sciences] and the producer, ZSNP [Slovak National Uprising Plant] in Ziar nad Hronom, on the problem of decreasing the dislocation density in GaAs monocrystals for laser structures. The mastery of these difficult monocrystalline materials and parallel research on physical diagnostic methods will make possible further research on optoelectronic components, particularly light sources.

Among dielectrics, the preparation of lithium tantalate monocrystals by the Czochralski method with radio-frequency heating has been developed on a laboratory basis. This material and the lithium niobate available from Monokrystaly Turnov are employed in planar structures for control of a light beam, such as switches, modulators, optical filters and the like.

A third group of materials for optoelectronics comprises those used for optical fibers and cables. It is fortunate that the most important material for producing the fibers is silicon tetrachloride, which is a waste product at TESLA Rožnov; CSAV has developed a process for purifying it. On the other hand, the development of special claddings for optical fibers has not yet been completed. The possibilities for international cooperation in this field and in the area of dopants for telecommunications fibers are being examined.

The materials technologies are creating the support base for the development of optoelectronic components and modules. Series production of a modular system for digital signal transmission at speeds of 0-10 Mb/sec over distances of hundreds of meters with a relative error rate below 10^{-9} is to be begun as early as 1985. By that time a wide range of optoelectronic products, so such as fast light-emitting diodes, an optical connector, and optical fiber and cable, will already be in production; only the photodetector will probably use some chips imported from the GDR. In addition, the electronic components are all produced by socialist countries.

The longer-range prospect involves components and parts for telecommunications equipment and related applications. In component technologies, Czechoslovak development activities will rely on the areas of work in the materials base described above. It is assumed that by 1990 we will have our own semiconductor light sources, including lasers, for the 0.85 micron and 1.3 micron bands and integrated PIN-FET [positive-intrinsic-negative field effect transformer] photodetector structures using $A^{III}B^{V}$ materials for both frequency bands, as well as planar structures in both glass and monocrystalline substrates for light beam control which will allow branching of optical connectors and the like. Optoelectronic transmitting and receiving modules for class 2 and 3 PCM signals will be delivered to communications equipment producers for installation in optical link termini and for use in wideband transmission systems. This will set the stage for important benefits to the national economy in the form of conservation of scarce raw materials, greater functional capabilities of the equipment, and the possibility of exporting products to foreign markets

Development of Hybrid Integrated Circuit Technology

The development of the film technologies which are the basis of hybrid integrated circuits [HIC] began with the vacuum-evaporated films which have long been in use in the optical industry and elsewhere.

Thin-film structures can be prepared by vacuum evaporation and recently have also been prepared by cathode sputtering. Vacuum evaporation has passed through several developmental stages: from large-scale successive deposition

of individual films on a large set of substrates using metal mases, through complex equipment for controlling masks, substrates and vaporizers in order to assure the ideal physical conditions for film production, to the current technique of producing sandwiches of the required films which are then photolithographically processed into particular circuits. For economic reasons, large-size substrates are used, on which as many as several dozen circuits are produced simultaneously. Of the main materials that have been investigated, their excellent electrical properties have made NiCr the most widely used material for resistors and SiO the most widely used material for capacitor dielectrics.

Cathode sputtering is an essentially different direction in thin-film technology; Ta_2N resistive films and Ta_2O_5 dielectric films prepared by anondization of sputtered tantalum have proved satisfactory.

The second type of film structure is thick films produced by printing and subsequent firing of special pastes. A large number of pastes for conductive, resistive, insulating and dielectric layers are in existence; development work is aimed at substantial improvement in their electrical properties and recently has focused on limiting or completely eliminating the use of precious metals.

At present, thick films are more extensively used than thin films because of their lower price and less demanding process equipment. Many producers of hybrid circuits are capable of handling both technologies and choose between then in terms of the required electrical properties of each circuit.

The installation and finishing operations in hybrid integrated circuit production are practically the same for thin and thick films. Experience shows that it is not economical always to insist on using a fully integrated passive circuit: add-on passive components, particularly capacitors, may be used to advantage. The sophistication of process equipment is continually increasing and it is already quite natural to use a highly productive program-controlled laser for high-precision trimming of resistors or for separating large substrates. The requirement for reliable installation of already-graded and highly complex IC chips in HIC or multichip modules has led to the development of a system for automated installation of these components, which are carried on an auxiliary carrier plate. Surface protection of the circuits in the form of a cover or sealed package affects their price and applicability.

The view that HIC have no technical justification and that all needs of the electronics industry are fully met by monolithic integrated circuits is already invalid. The customer-oriented character of HIC's, the cheapness of producing them even in relatively small series (frequently less than 1,000 pieces a year), and the ability of hybrid circuits to "integrate further what has already been integrated" justify their existence and extensive application. The delay in putting them into production and the resulting attempts by several final producers to conduct their own small-series production are only the results of our slow response to worldwide developments and the needs of the final producers.

In telecommunications, maximum use will be made of monolithic integrated circuits because of the nature of the electrical circuits involved and their highly repetitive character. The introduction of HIC's will be cost-effective only for certain types of circuits which it will be technically impossible or economically undesirable to produce in monolithic form, e.g., phase-locked loops [fazovy zaves], coder-decoders, regenerative amplifiers in class 1 and 4 systems and the like. In the long term we can expect greatly increased use of HIC as electronics is introduced into telephone exchanges and auxiliary equipment.

* * *

Accordingly, silicon-based microelectronics technology (monolithic integrated circuits) will be used for components with a high degree of replication produced in large numbers.

It will be technically and economically beneficial to use hybrid technology for components with a lower degree of repetitiveness which are subject to stringent demands with regard to certain characteristics (e.g., precise values, power loads, integrated installation on passive substrates).

A completely new generation of optoelectronic components, including optical fibers and cables, is appearing for use in optical communications systems using transmission via dielectric fibers.

8480
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IMMEDIATE FUTURE ENGINEERING PRODUCTION TASKS VIEWED

Prague JEMNA MECHANIKA A OPTIKA in Czech No 8, Aug 82 pp 197-199

[Article by Dr Jan Vintera: "Immediate Tasks of Engineering Production"]

[Text] In the previous three articles, we tried to show what arguments were used 30 years ago to determine the role of the engineering industry in the Czechoslovak national economy, how the engineering industry fulfilled that role, and what its present status is. What remains for us to do is to tell in one or two articles what awaits the engineering industry and with it also our entire national economy in the forthcoming years. Indeed, our journal has previously published a whole series of articles about the long-term concept of the Czechoslovak engineering and electrotechnical engineering industries up to the year 2000. What is left to do now is to clarify the period up to 1985, a period which originally was to be conceived as the period of the Seventh 5-Year Plan. The Sixteenth CPCZ Congress also originally evaluated this period and the tasks of the engineering industry. Therefore, we could claim that the tasks of the engineering industry have been set in its resolution, and that it would be enough to merely elaborate them. However, unfortunately the situation is more complicated, and it has become even more so in 1981. It is true that we knew about the very unfavorable situation in the purchasing of raw materials, and that we could not have illusions that perhaps the prices of raw materials would keep decreasing. But what we could not know was that the international situation would deteriorate so dangerously, and that it would have such unfavorable impacts on the Czechoslovak national economy.

First of all, trade competition with Czechoslovak exports, including exports of machinery, has increased further. Measures taken by strong Western states against imports of Czechoslovak goods are being intensified. Quantitative restrictions of imports are becoming global; they apply now to the entire EEC but one cannot act against individual members and take advantage of various cases of harshness in their quota policy, and customs regulations and other measures are becoming harder. The Western states are not bothered by the fact that all this is in conflict with the so-called GATT international agreement, which not only does not allow import restrictions, but actually requires that all states which have signed the agreement be granted the same conditions of imports.

There began to appear also the first symptoms of imposing embargos on exports from capitalist states to socialist countries. A well-known case is the case of the embargo on exports of computers to the USSR, and most recently deliveries of parts of gas pipeline equipment for deliveries of natural gas from the USSR to Western countries. Tomorrow, it may apply to progressive technology. To put it simply, anything goes when one wants to do harm to international trade.

Besides, much is explained by Comrade Bilak's contribution to the discussion at the plenum of the CPCZ Central Committee held last February, if we are able to interpret it in terms of economic life. It is a question of the attitude of capitalist banks. Comrade Bilak stated: "The aggressiveness of imperialism is reflected sharply in the latest period not only in an intensification of armament and economic discrimination against socialist countries, but also in a radical deterioration of international financial and credit relations. Western banks, acting under pressure of the United States, proceeded de facto to bring about a financial blockade of the socialist countries. Imperialism reminds us again by this example that its "cooperation" follows only its own interests. We must draw conclusions and a lesson from it for designing a strategy in the area of our foreign financial and credit policy."

This means that purchases of raw materials or grains from capitalist states will be made more difficult not only by high prices, which are several times as high as compared to prices 5 to 7 years ago, but also by blocking credits which we used to purchase some commodities from capitalist states. In doing that, capitalist banks cannot use as a pretext an allegation that perhaps we might not make installment payments for their loans exactly on time. On the contrary, we are considered in the world in that respect to be a solid partner. However, the motives for taking such an attitude are nothing but political.

And so, the present times dictate the following for a period of at least up to 1985, as far as the engineering industry is concerned:
--to manage with supplies of raw materials, especially metals and fuels, which will not be larger than they were in 1980;
--to increase engineering industry production by 28 percent in 1985 as compared to 1980, in the spirit of the law on the Seventh 5-Year Plan;
--to develop this production in principle with an overall freeze in manpower;
--to emphasize substantially the active role of the engineering industry in the external relations with both areas of the world.

If we start with the assumption that one cannot deal in a stereotyped way with the entire period up to the year of 2000, then this entire period of 20 years looks about as follows:

1. Fulfillment of the tasks for 1982, which are characterized by the stagnation of development and essentially also of the basic content of engineering industry production, with the exception of electronics.

2. The 1983-1985 period, which shows a beginning of the process of intensification, even in the engineering industry, a period in which it is necessary to switch at last from talking to acting. This means that by that time one must see clearly the results of efficiency and intensification, implementation of the process of structural changes and the results of scientific and technical development, implementation of the tasks in the area of reestablishing balance in external relations.

3. The period of the Eighth 5-Year Plan. This 5-year plan must be based consistently on the idea of acceleration of the intensification process, above all by bringing about desirable structural changes, more intensive utilization of scientific and technical development and of the order of innovations, and by large-scale integration of the engineering industry in the form of socialist economic integration. It is necessary even in the engineering industry to help to bring about a balanced process of renewal of structural harmony between resources and needs. It will be indispensable to work out the tasks of intensification of the role of the engineering industry as a producer of foreign currency and as one of the main factors of increasing the level of the productive and technical base, and of stopping the decline of directive relations in foreign trade.

4. The period after 1990, which by that time must assume the character of full renewal of dynamic development, not in the optical and old quantitative sense of the word, but as a result of internal qualitative factors of growth.

The entry of the Czechoslovak engineering industry in the period of 1990-2000 will depend to a considerable extent on how fast this industry will adapt itself to the new conditions.

Certain development trends apply to the engineering industry during the next period, that is, during the Seventh 5-Year Plan. We must state at the outset that these trends apply both for the long-term period as well as for the initial stage of this period.

In terms of resources, the basic development trends consist in consistent implementation of measures designed to make savings, to keep increasing the value added of input materials, and to integrate fully the activity of the human factor.

For the period up to 1985, we cannot expect even a 1 percent growth of metal resources for the engineering industry and, with regard to energy, it is possible that there will be actually a decline of fuels and energy resources.

As to deliveries for investment construction in the entire national economy, one has to expect that the absolute volume of investments in the national economy will be maintained at the 1985 level, rather than that there would be any sort of increase. The concept of investment development concentrates on a qualitative development of the production base of individual industrial branches, particularly in basic technological groups of machinery and equipment, accompanied by a growth of the share of electronics in the overall investment requirements.

Within the area of industrial investments, it will be necessary to provide for a faster rate of speed of deliveries for the fuels and energy complex. The share of the nonproduction sphere in overall investments should decline below the level of the Sixth 5-Year Plan. It is evident that there will be an increase of the share of investments of an ecological nature, particularly in fuels, energetics, metallurgy and chemical industry.

It is true that the rate of deliveries for marketing funds will be faster than the rate of overall retail turnover, but since retail turnover itself will grow very slowly due to slow growth of the purchasing power of the population, the rate of deliveries of consumer goods produced by the engineering industry will be much slower than in the past. Even in the immediate future years, the impulses for consumer demand must be based on the engineering and electrotechnical engineering industries on clear innovation and enrichment of the production assortment. Electronics will be the dynamic factor in this category of deliveries. It will considerably exceed its present share of overall deliveries for the marketing funds (over 15 percent). The application of electronics must also make household equipment more saleable. As early as this year, the Brno Fair of consumer goods revealed as a clear pressure on consumer electronics and gave proof that it works.

The period up to 1985 will also have to be a start of proexport orientation of the engineering and electronics industries. The technical, investment, production and marketing policies of both industries must be fully influenced by this requirement, the management of all levels and in all elements must be adapted to it. This is indicated not only by the growing demands for an active foreign-trade balance in the production of both industries, but also by the fact that it is absolutely necessary to overcome autarchic trends which create insurmountable barriers for a growth of efficiency and competitive capacity of engineering industry production. Proexport, pro-import, and prointegration orientation of the development of the engineering and electrical engineering industries determines their future position in the Czechoslovak economy, the implementation of their functions in the national economy.

Three questions which literally move the world, the community of the socialist states, and even more so the CSSR, will constitute an entirely special problem of the development of the engineering and electrotechnical engineering industries. They are:
--the question of how to handle the fuels and energy situation;
--how to provide enough food and in this connection also enough fodder; and
--how to protect life and the living environment against unfavorable ecological effects of economic development.

In addition, there exists a special key question of the entire Czechoslovak economy, and of the engineering industry in particular, namely the integrational relationship with regard to the USSR. Roughly speaking, the relationship of the Czechoslovak engineering industry with the Soviet engineering industry is a relationship of a relatively strong bond. Better to say, the

export of machinery to the USSR represents a very strong profile not only of all Czechoslovak exports, but also of the entire structure of the engineering industry in general. Examples of it are well known: electrical and Diesel locomotives, rolling equipment, trolleybuses, parts of nuclear electric power plants, textile machinery, food-processing installations, chemical industry installations, transmitters, telecommunication equipment, and so on.

However, the export structure of machinery exported to the USSR was formed almost always on the basis of requirements of Soviet customers, not on the basis of Czechoslovak offers of supply which should be totally justified and intensively negotiated. It is true that this has created a stable situation in terms of demand by the USSR, but at the same time it has brought about the profile forming of the Czechoslovak engineering industry, which does not correspond in all cases to the economic conditions under which the Czechoslovak engineering industry is developing. We have in mind the fact that the structure of the engineering industry exercises pressure on production of energy and metals, refined materials, in terms of heavy production areas, and so on.

However, the export structure of machinery exported to the USSR was formed almost always on the basis of requirements of Soviet customers, not on the basis of Czechoslovak offers of supply which would be totally justified and intensively negotiated. It is true that this has created a stable situation in terms of demand by the USSR, but at the same time it has brought about the profile forming of the Czechoslovak engineering industry, which does not correspond in all cases to the economic conditions under which the Czechoslovak engineering industry is developing. We have in mind the fact that the structure of the engineering industry exercises pressure on production fields and products which are excessively demanding in terms of consumption of energy and metals, refined materials, in terms of heavy production areas, and so on.

Naturally, that is not some sort of a "fault" by the Soviet customers, but rather a lack of Czechoslovak initiative in offering export goods to the USSR. For example, let us consider the fact that the USSR is importing a tremendous amount of machinery from advanced capitalist states, ranging from machinery for the technology of its own engineering production, through equipment for chemical and food-processing industries, computers and electronic products in general, and to heavy trucks. We do not think at present that we could take over, for example, deliveries of certain computers which the USSR was or is importing from the West, or microprocessor technology. However, what is certainly lacking is our initiative in the area of chemical and food-processing installations, machine tools and forming machines, gas turbines, and so on.

Therefore, it is now a question of working out a Czechoslovak concept of a more penetrating integration of the Czechoslovak engineering industry in such a way that the problems of the Czechoslovak engineering industry would be easier to handle by this integration with the USSR, instead of being actually made more complicated by inept handling.

First of all, fuel and energy resources are consumed directly in the engineering industry, but also indirectly. Indeed, the larger the amount of initial material consumed in the building of machines in relation to the final use or unit of output of the machine, the more fuel and energy is consumed in practice, because all input production materials and semi-finished products, whether they be metals or plastics, are greatly demanding in terms of energy.

Whenever a machine is made lighter, whenever a progressive change is made in the technology, the result is not only savings of metal, but, at the same time, related savings of fuels and energy.

The second item in the relationship between the engineering industry and dealing with the energy problem is the matter of handling the production of machinery and equipment for the development of fuels and power resources, either of the classic or of the nonclassic type, and the matter of providing such machines and equipment which consume fuels and energy in their operations and will consume more rationally these fuels and energy per unit of output. This item also includes the production of machinery and equipment which bring about structural changes in the national economy and lead to a decrease of the consumption of fuels and energy on the scale of structural changes in the national economy. I will give examples of all of this.

With regard to the first question, namely consumption of metals and energy by engineering production for production purposes, the question is how to achieve a 28 percent increase of engineering industry production in 1985 as compared to 1980 and how not to consume more metals and energy than the industry consumed in 1980. To put it in figures: the engineering industry must manage in 1985 with 6.3 million tons of ferrous metals and about 6.2 tmp [tons of standard fuel] of energy, which it had in 1980. This means that it must reduce the specific consumption of metals from 34.5 tons per million korunas of the production of goods in 1980 to 27 tons per million korunas in 1985. This goal can be reached in two ways: by using for production in the technological production process itself a smaller amount of metals and energy and, second, by building machines which are characterized by smaller weight for the same unit of output, or by the same weight for a higher output unit. We think, for example, about reducing the share of machining in the methods of production technologies, or about using welded pieces, pipes, plastics, and so on, instead of using full material. For the time being, we process only 13 percent of the machined material by the forming method. However, experience shows that we could use the method to process as much as one-third of the material.

With regard to the second method, the question is how to provide fully for energy resources used for production purposes, for example by manufacturing high-quality machinery which does not break down for surface mining of brown coal, machinery for manufacturing nuclear installations designed for fully developed construction of nuclear electric power plants, for construction of machinery used in the power industry, which is oriented particularly to the cosntruction of hydroelectric turbines, gas turbines, boilers, steam turbines. In this connection, it should also be a question of building machines and

installations for the production of energy from nonclassic sources, that is, machines using solar energy for heating, small gas turbines and gas motors using biological gas, turbines for use of small watercourses, equipment for using thermal differences (for example, for refrigeration of fresh milk).

However, while installations are needed to produce the necessary sources of energy, there is also need to build machines which consume less energy than the existing machinery. We have in mind production of economic oil and gas motors, electric, cement, brick and other furnaces which consume less heat. It will be a question of providing machinery and equipment to deal with the problem of transportation by switching to electric traction, for example to the construction of electric locomotives, trolleybuses, streetcars, suburban electric trains.

Another serious problem on a worldwide scale and on a Czechoslovak scale is the problem of nutrition, or on a worldwide scale the problem of eliminating the threat of starvation and undernourishment of mankind. This is not an abstract problem even for us. It is literally a problem which is knocking on the door. At the same time, a considerable portion of its solution is in the hands of the engineering industry. Above all, it will be a question of completing the system of agricultural machines, where there still exist gaps, especially in animal production. It will be a question of evaluating the present orientation of the structure of agricultural machinery, which in the past years showed continuously a tendency toward increasingly larger, heavier and, in terms of energy, more demanding machines, a tendency to depreciate the soil. Farmers must be supplied with an agricultural truck not only for transportation reasons but also precisely for energetic reasons, and tractors, which are more demanding in terms of energy, must be eliminated from transportation.

We will have to consider seriously not only the problem of taking full care of the needs of production and processing of food, but we must not ignore questions such as total utilization of all vegetable and animal waste material, or nontraditional raw materials, such as, for example feathers, innards, cadavers, protein components of excrements, and especially we must start to develop biological substances starting with straw, leaves, wood, all the way to the so-called green juices derived from papilionaceous fodder. All this requires machinery and again machinery, machinery of a high technical level.

The ecological problem can be also influenced to a considerable extent by the engineering industry. After all, we know how to build plants for treatment of urban and industrial waste material, in fact we can build such plants of a high technical level. We have water purification plants of high quality, we are starting to use successfully the process of desulphuration of coal containing sulphur, we have a very strong pneumatic engineering industry. All we have to do is to combine all this into a single system and use it for a complex ecological intervention.

More than enough lies ahead for our engineering industry til 1985 and we expect much from it. One could almost say that they are more serious

and harder problems than those we faced in the past. It is indeed easier and visually more demonstrable when good results are achieved in the extensive stage of development, than when we are dealing with tasks of economical use and rationalization during the intensive development stage of the national economy.

But let us believe that our mechanical engineers will carry out these tasks just as they have carried out all the previous tasks.

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CSO: 2402/5

BRIEFS

LABORATORIES FOR USSR--Labora Praha [Prague], an organization of concern Sklo [Glass] Union in Teplice, delivers yearly over 400 complete laboratories to the USSR under a long-term contract effective until 1985. Most of the laboratories from Labora are exported through foreign trade establishment Kovo. Exported laboratories in the USSR are serviced by Czech-trained Soviet personnel who work for several plants of Agropribor organization. [Prague RUDE PRAVO in Czech 12 Nov 82 p 5]

CSO: 2402/14

SCHOLARSHIP COUNCIL TRANSFERRED TO SCIENCE POLICY COMMITTEE

Budapest MAGYARORSZAG in Hungarian 21 Nov 82 p 2

[Excerpts] The government has enacted a resolution aimed at modifying the tasks, organization and regulations under which the National Council for Scholarships operates and has put it under the authority of the Science Policy Committee. The ranks of the Council have been increased substantially through addition of scientists, researchers and artists. The purpose of the measure is to make more efficient use of scholarships and to refine selection of recipients.

The measure has far-reaching effects: in 1981, alone, 2,000 Hungarians were awarded scholarships to 29 capitalist countries where they spent a total of 5,750 months. A great many more students studied for varying periods in the socialist countries. The value of such study tours lies chiefly in the development they produce in our economic, scientific and technological life. They are a bountiful source which we must use to the utmost. This applies to the natural, agricultural, medical, technical and social sciences alike.

Such scholarships are also a way of making our achievements known abroad whenever we offer exchange scholarships.

In pursuing the better utilization of scholarships, the government is striving to improve the international political climate. Not only are such exchanges an important element of peaceful coexistence, but they also improve the atmosphere for detente. Scientific and cultural interests which no politician can ignore play a role in the relations which result from scholarships. Whoever attempts to impede such exchanges isolates his country from the world. On this issue, the Hungarian government favors relations.

CSO: 2502

END